

***Sciadocephalus megalodiscus* Diesing, 1850 (Cestoda: Corallobothriinae), a Parasite of *Cichla monoculus* Spix, 1831 (Cichlidae), in the Paraná River, State of Paraná, Brazil**

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ABSTRACT: *Sciadocephalus megalodiscus* Diesing, gen. et sp. inquirenda, is redescribed from the tucunaré, *Cichla monoculus* Spix, collected in the Paraná River, Brazil. The position of the reproductive system of the parasite is clarified, thus revalidating the genus and species. *Sciadocephalus megalodiscus* is recorded from the Paraná River for the first time.

KEY WORDS: Cestoda, Proteocephalidae, *Sciadocephalus megalodiscus*, *Cichla monoculus*, Cichlidae, Teleostei, Paraná River, Brazil.

The basis of the taxonomy of the South American cestodes of the Order Proteocephalidea Mola, 1928, parasitizing freshwater fishes was established by W. N. F. Woodland, who, in a series of studies published in the 1930's, described numerous proteocephalid parasites of fishes of the Amazon basin. Some older species were described by Diesing (1850, 1855). Interest in these helminths has increased recently, and new cestodes are frequently being added to the South American species list (Rego et al., 1999). Some of the older species were placed as species inquirenda, as is the case with *Sciadocephalus megalodiscus* Diesing, 1850, which Diesing (1850) described from the tucunaré, *Cichla monoculus* Spix, 1831, collected in the state of Mato Grosso, Brazil. This parasite was later found by Woodland (1933) in Amazonia from the same fish species. Because there were doubts as to the subfamily to which this species belonged, because the position of the reproductive organs (a fundamental character in classification of the taxon) was unclear, Wardle and McLeod (1952) and Rego (1994) preferred to treat it as genus and species inquirenda.

Sciadocephalus megalodiscus had not previously been found in the Paraná River. It is important to note that *C. monoculus* is not native to the Paraná River, where it was introduced some years ago. Recently, one of us (P.M.M.) had the opportunity to collect several specimens

of this parasite, and with the present description, the genus and species are revalidated.

Materials and Methods

A total of 136 *C. monoculus* were caught in the Paraná River from July 1996 through October 1997. After removal from the intestine, the cestodes were fixed in 4% hot formalin. Cestodes were stained with alcoholic carmine or Delafield's hematoxylin, dehydrated in an alcohol series, cleared in Eugenol® or in beech creosote, and mounted in Canada balsam. Cestodes for histological sections were embedded in paraffin, cut in 8 µm cross-sections, and stained with hematoxylin and eosin. Illustrations were made with the aid of a drawing tube. Measurements are in millimeters (mm). Photomicrographs were made with a scanning electron microscope (SEM). The terms "prevalence" and "mean intensity of infection" are used according to Bush et al. (1997). Representative specimens were deposited in the Helminthological Collection of the Fundação Instituto Oswaldo Cruz (FIOCRUZ), Rio de Janeiro, state of Rio de Janeiro, Brazil, under accession numbers 33951, 33952, and 33953a–c.

Results

Proteocephalidae La Rue, 1911

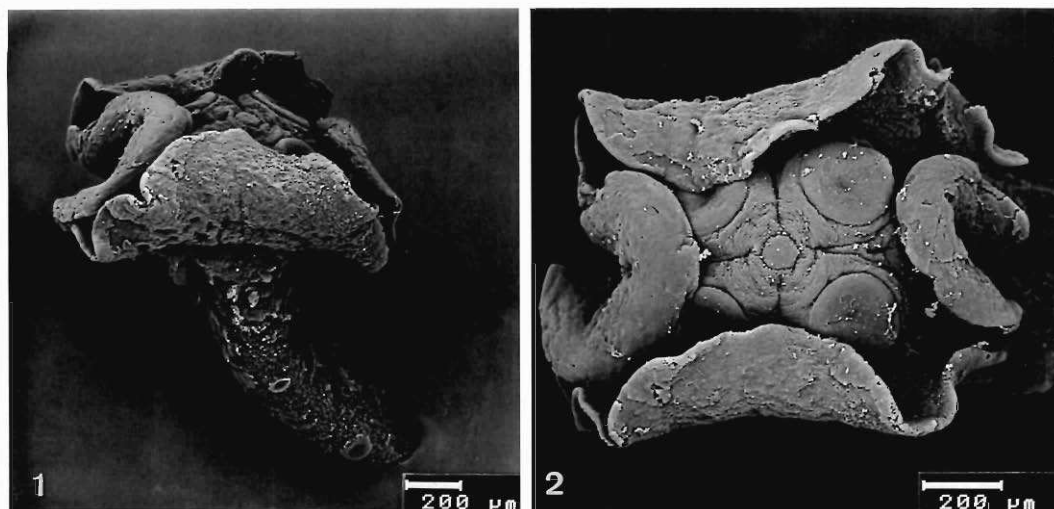
Corallobothriinae Freze, 1965

***Sciadocephalus megalodiscus* Diesing, 1850 (Figs. 1–7)**

Description

GENERAL (based on 11 specimens): Strobila 6.1–9.3 (7.9) long × 1.1–1.7 (1.3) wide. Strobila comprised of 17–22 proglottids, including 6–8 (7) immature proglottids, 4–6 (5) mature proglottids, 8–12 (10) gravid proglottids. All proglottids several times wider than long. Scolex

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Figures 1, 2. SEM photomicrographs of *Sciadocephalus megalodiscus* Diesing, 1850. 1. Small specimen (entire). 2. Scolex and metascolex. Apical view.

wider than strobila, with umbrella-shaped metascolex with borders turned upwards. Scolex enveloped by these borders, comprised of 4 muscular suckers and 1 apical sucker (Figs. 1–3). Scolex and metascolex 1.4–2.2 (1.9) long \times 2.8–2.9 (2.8) wide; suckers 0.385–0.515 (0.454) in diameter and apical sucker 0.115 in diameter. Neck inconspicuous. Immature proglottids wider than long, 0.1 \times 1.8 to 0.2 \times 1.4 (0.2 \times 1.6). Gravid proglottids wider than long, 0.3 \times 1.8 to 0.9 \times 1.4 (0.6 \times 1.7). Last few proglottids more

or less rectangular. Genital opening in anterior $\frac{1}{3}$ of proglottid, alternating irregularly. Vagina opening anterior or posterior to cirrus pouch. Vaginal sphincter inconspicuous. Cirrus pouch long and narrow, 0.3 \times 0.1 to 0.4 \times 0.1 (0.4 \times 0.1). Cirrus pouch about 0.2 times width of proglottid. Testes about 26, medullar, 0.07 in diameter, arranged in 2 distinct fields, separated by ovary. Ovary medullar, compact, indistinctly bilobate, central, 0.415–0.465 (0.442) in width. Vitellaria medullar, diffuse, not forming follicles, occupying lateral body region. Uterus medullar, rapidly resolving into capsules containing varying numbers of eggs. In last segments, some capsules not containing eggs and modified in form (Figs. 4, 7). Some capsules passing from medulla to cortex, opening through tegument. Eggs not containing developed embryos. Hexacanth hooks not observed. Musculature with numerous isolated longitudinal fibers, distributed throughout entire proglottid. Demarcation between medulla and cortex indicated by delicate transverse fibers situated next to longitudinal fibers (Fig. 6). Tegument of strobila with 2–4 longitudinal sulci (Fig. 5).

Taxonomic summary

HOST: *Cichla monoculus* Spix, 1831 (Cichlidae), “tucunaré.”

LOCALITY: Paraná River, region of Porto Rico, State of Paraná, Brazil.

SITE OF INFECTION: Intestine.

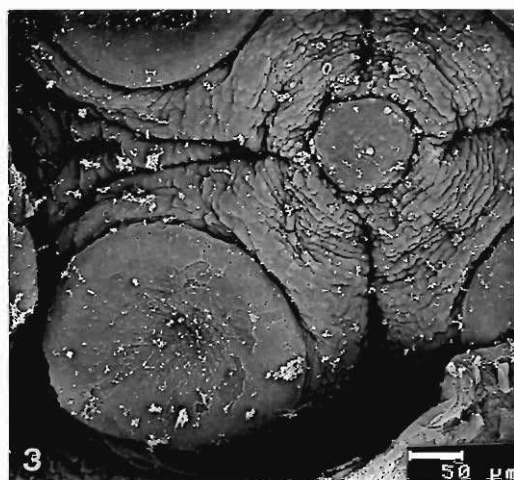
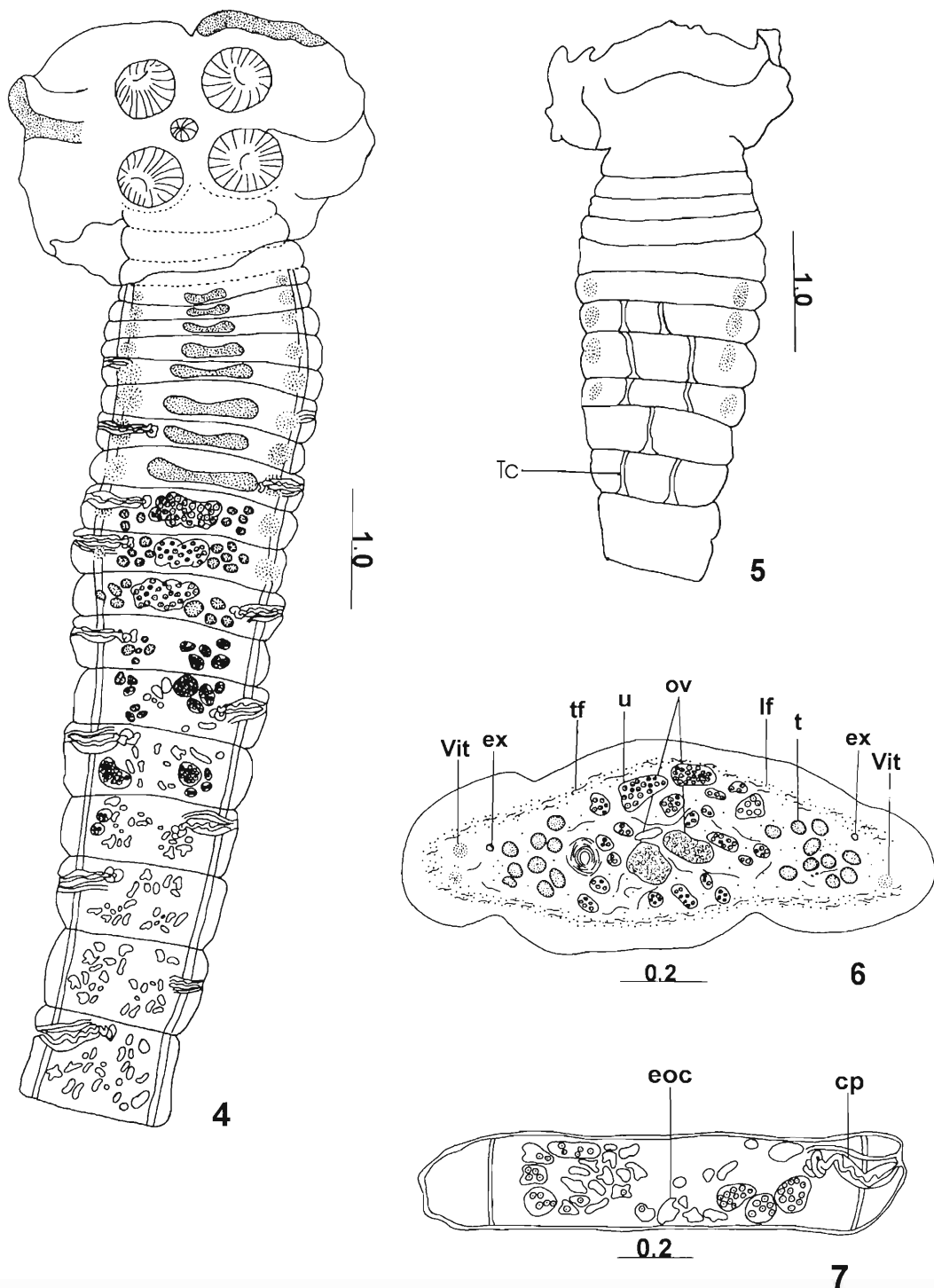


Figure 3. SEM photomicrograph of the scolex, detail of a sucker and apical sucker of *Sciadocephalus megalodiscus* Diesing, 1850.



Figures 4-7. *Sciadocephalus megalodiscus* Diesing, 1850. Scales in millimeters (mm). 4. Entire specimen; note that most proglottids are gravid. 5. Small specimen; note small sulci present on tegument (tc). 6. Cross-section of gravid proglottid, showing vitellaria (Vit), excretory canal (ex), testes (t), transverse fibers (tf), uterus (u), ovary (ov), longitudinal fibers (lf). 7. Gravid proglottid; note some ovigerous capsules with eggs and others without eggs and modified; empty ovigerous capsule (eoc), cirrus pouch (cp).

PREVALENCE: 13.2%.

MEAN INTENSITY OF INFECTION: 8.6.

Discussion

This is the third report of *S. megalodiscus*. The species was initially described by Diesing (1850) from *C. monoculus* in the state of Mato Grosso, Brazil. Woodland (1933) redescribed it from the same fish species in Brazilian Amazonia. The latter author's description of the arrangement of the reproductive system was incomplete in that he did not note whether this system is medullar or cortical. Woodland (1933, p. 193) stated that "It is important to note that a definite band of longitudinal muscle fibres is entirely absent, though individual fibres may be scattered in the parenchyma. There is no question as to organs being medullary or cortical in position." The classification system for proteocephalids (sensu Freze, 1965) defined 2 families, Proteocephalidae and Monticelliidae, according to whether the gonads are located in the medullar or cortical parenchyma. For this reason, some authors (Wardle and McLeod, 1952; Rego, 1994) considered the genus and species as inquirenda.

Sciadocephalus megalodiscus have no groups of longitudinal fibers separating the cortex from the medulla (Woodland, 1933). However, as described in the present work (Fig. 6), the isolated fibers, together with the transverse fibers, sufficiently delimit the medulla from the cortex. We can therefore determine that the gonads and the vitelline glands are entirely medullar. Vitellaria do not form true follicles as in the majority of the proteocephalids, but appear as diffuse bodies, arranged laterally in the proglottids.

The metascolex is the most interesting characteristic of this species. Its umbrella form is different from typical "collar-type" metascolices found in genera of proteocephalids such as *Amphoteromorphus* Woodland, 1935; *Goezeella* Fuhrmann, 1916; and *Spatulifer* Woodland, 1934. Rego (1999) defined the metascolex as "any development of folds and wrinkles in the posterior part of the scolex or on the surface of the scolex proper, encircling the suckers or not." There are several types of metascolex, as many as the number of described species with metascolices. The scolex of *Sciadocephalus* has some resemblances to that of *Corallotaenia* Freze, 1965. Brooks and Deardorff (1980) reported an unidentified *Corallotaenia* sp. from the flatnose

catfish, *Ageneiosus caucanus* Steindachner, 1880, in Colombia. Unfortunately, the authors did not provide a formal description of the worms. *Sciadocephalus* differs from *Corallotaenia* by the umbrella-shaped metascolex, the disposition of the ovary, the nonfolliculate vitellaria, and the uterus resolving into ovigerous capsules. It is important to emphasize that the other South American genera that possess a metascolex have the reproductive systems arranged variously, but partly or entirely located in the cortical parenchyma. *Sciadocephalus megalodiscus* is an exception; the gonads and vitellaria are entirely medullar.

Brooks and Rasmussen (1984) stated the importance of the metascolex to eliminate cases of parallel evolution in a cladogram. However, subsequent authors did not attribute much importance to these structures, probably because of difficulties in characterizing the metascolex types. Rego et al. (1999) produced a phylogenetic analysis of the subfamilies of Proteocephalidea, but in regard to the character metascolex, they stated: "only two states (presence versus absence) were considered until such time as the various forms of metascolices are clearly defined and distinguished." The preliminary results of a phylogenetic analysis of South American genera (Rego et al., unpubl.) indicate a closer phylogenetic relationship between *Sciadocephalus* and *Megathylacus* Woodland, 1935. It therefore becomes necessary to present a new generic diagnosis in order to revalidate the genus.

Sciadocephalus Diesing, 1850

GENERIC DIAGNOSIS: Strobila small. Scolex wider than strobilus. Metascolex umbrella-shaped, sometimes with edges turned upwards. Suckers muscular, round, and turned upwards. Apical sucker conspicuous. Genital openings alternating in regular fashion. Ovary compact, central. Testes in 2 fields, separated by ovary. Vitellaria diffuse, not forming follicles. Cirrus pouch elongate. Vaginal opening posterior or anterior to cirrus pouch. Uterus rapidly resolving into ovigerous capsules, with varying numbers of eggs. Eggs not embryonated. Longitudinal canals in tegument of strobilus. Gonads and vitellaria entirely medullar. Musculature consisting of numerous isolated, irregularly arranged longitudinal fibers, present in medullar parenchyma, but concentrated in cortex/medulla separa-

tion. Cortex/medulla separation best characterized by presence of transverse fibers.

Acknowledgments

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Literature Cited

- Brooks, D. R., and T. L. Deardorff.** 1980. Three proteocephalids from Colombian siluriform fishes, including *Nomimoscolex alovarius* sp.n. (Monticelliidae: Zygobothriinae). *Proceedings of the Helminthological Society of Washington* 47:15–21.
- , and **G. Rasmussen.** 1984. Proteocephalidean cestodes from Venezuelan siluriform fishes, with a revised classification of the Monticelliidae. *Proceedings of the Biological Society of Washington* 97:748–760.
- Bush, A. O., K. D. Lafferty, J. M. Lotz, and A. W. Shostak.** 1997. Parasitology meets ecology on its own terms: Margolis et al. revisited. *Journal of Parasitology* 83:575–583.
- Diesing, K. M.** 1850. *Systema Helminthum*. Vol. 1. Wilhelm Braumuller, Vindobonae. 679 pp.
- . 1855. Sechzehn Gattungen von Binnewürmen und ihre Arten. *Denkschriften der Kaiserlichen Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Classe* 13:556–616.
- Freze, V. I.** 1965. *Essentials of Cestodology*. Vol. 5. Proteocephalata in Fish, Amphibians and Reptiles. Izdatel'stvo Nauka, Moscow. 538 pp. (In Russian; English translation, Israel Program for Scientific Translation, 1969.)
- Rego, A. A.** 1994. Order Proteocephalidea Mola, 1928. Pages 257–293 in L. F. Khalil, A. Jones, and R. A. Bray, eds. *Keys to the Cestode Parasites of Vertebrates*. Commonwealth Agricultural Bureaux International, St. Albans, U.K.
- . 1999. Scolex morphology of proteocephalid cestode parasites of neotropical freshwater fishes. *Memórias do Instituto Oswaldo Cruz* 94:37–52.
- , **J. Chubb, and G. C. Pavanelli.** 1999. Cestodes in South American freshwater fishes: keys to genera and brief descriptions of species. *Revista Brasileira de Zoologia* 16(2):(in press)
- , **A. de Chambrier, V. Hanzelova, E. Hoberg, T. Scholz, P. Weekes, and M. Zehnder.** 1998. Preliminary phylogenetic analyses of subfamilies of the Proteocephalidea (Eucestoda). *Systematic Parasitology* 40:1–19.
- Wardle, R. A., and J. A. McLeod.** 1952. *The Zoology of Tapeworms*. University of Minnesota Press, Minneapolis. 780 pp.
- Woodland, W. N. F.** 1933. On the anatomy of some fish cestodes described by Diesing from the Amazon. *Quarterly Journal of Microscopical Science* 76:175–208.

Obituary Notice

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1920–1999

Elected to Membership in 1951;

Recording Secretary, 1957;

Vice President, 1962 President, 1963;

Editor, 1967–1970; Life Member, 1983;

Anniversary Award, 1991